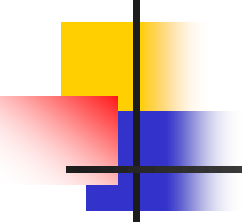


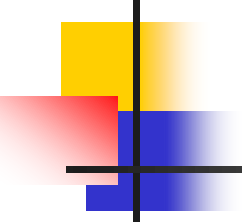
CUBES AND CUBE ROOTS



Cube Roots

The index of a **cube root** is always **3**.

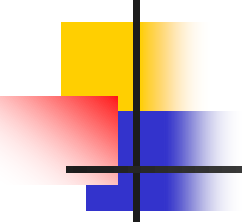
The cube root of 64 is written as $\sqrt[3]{64}$.



What does cube root mean?

The **cube root** of a number is...

...the value when multiplied by itself three times gives the original number.



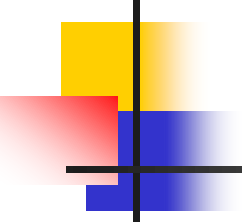
Cube Root Vocabulary

index

radical sign

radicand

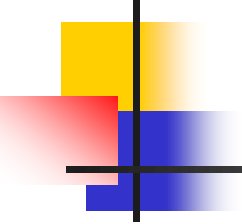
$$\sqrt[n]{x}$$



Perfect Cubes

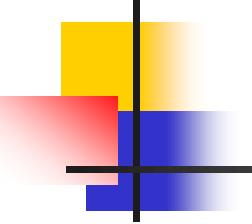
If a number is a **perfect cube**, then you can find its **exact cube root**.

A **perfect cube** is a number that can be written as the **cube** (raised to third power) of another number.



What are Perfect Cubes?

- $1^3 = 1 \times 1 \times 1 = 1$
- $2^3 = 2 \times 2 \times 2 = 8$
- $3^3 = 3 \times 3 \times 3 = 27$
- $4^3 = 4 \times 4 \times 4 = 64$
- $5^3 = 5 \times 5 \times 5 = 125$
- and so on and on and on.....



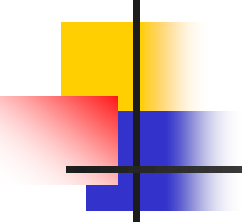
Examples:

$$\sqrt[3]{64} = 4 \text{ because}$$

$$(4)(4)(4) = (4)^3 = 64$$

$$\sqrt[3]{-64} = -4 \text{ because}$$

$$(-4)(-4)(-4) = (-4)^3 = -64$$



Examples:

$$27 = 3^3$$

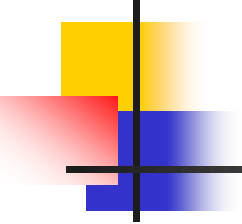
$$\sqrt[3]{27} = 3$$

$$216 = 6^3$$

$$\sqrt[3]{216} = 6$$

$$\frac{64}{125} = \left(\frac{4}{5}\right)^3$$

$$\sqrt[3]{\frac{64}{125}} = \frac{4}{5}$$



Examples:

$$8a^3 = (2a)^3$$

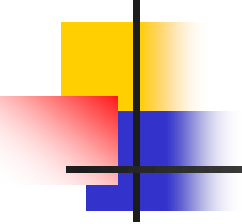
$$\sqrt[3]{8a^3} = 2a$$

$$27m^{12} = (3m^4)^3$$

$$\sqrt[3]{27m^{12}} = 3m^4$$

$$-64y^{15} = (-4y^5)^3$$

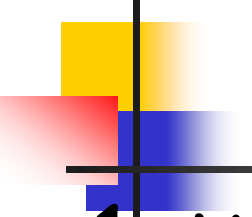
$$\sqrt[3]{-64y^{15}} = -4y^5$$



Simplify Cube Roots

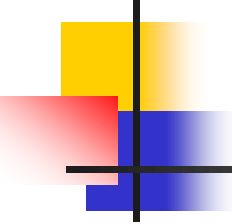
Not all numbers or expressions have an exact cube root as in the previous examples.

If a number is **NOT** a perfect cube, then you might be able to **SIMPLIFY** it.



To simplify a cube root ...

- 1 Write the radicand as a product of two factors, where one of the factors is a perfect cube.
- 2 Extract the cube root of the factor that is a perfect cube.
- 3 The factors that are not perfect cubes will remain as the radicand.



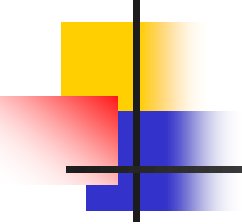
Examples:

$$1) \sqrt[3]{54} = \sqrt[3]{27 \cdot 2} = 3\sqrt[3]{2}$$

$$2) \sqrt[3]{640} = \sqrt[3]{64 \cdot 10} = 4\sqrt[3]{10}$$

$$3) \sqrt[3]{500a^7b^5} = \sqrt[3]{125 \cdot 4} \cdot \sqrt[3]{a^6a} \cdot \sqrt[3]{b^3b^2} =$$
$$\sqrt[3]{125a^6b^3} \cdot \sqrt[3]{4ab^2} = 5a^2b\sqrt[3]{4ab^2}$$

perfect cube



Not all cube roots can be simplified!

Example: $\sqrt[3]{30}$

- 30 is not a perfect cube.
- 30 does not have a perfect cube factor.

$\sqrt[3]{30}$ cannot be simplified!

Concept Map

